Coffee Conundrum

CONTENT AREAS

- **Math**
  calculations, volume
- **Science** resources

OBJECTIVES

Students will…

- calculate the amount of waste generated by steel coffee cans and coffee brick packs that is not recovered by recycling
- calculate the amount of fuel saved in transporting coffee cans versus coffee brick packs
- understand that the reason for reducing, reusing and recycling is to conserve resources
- understand that not all recyclable materials are recycled, and a percentage ends up in a waste facility; and understand recycling is a process that also uses resources
- learn that if you start with less material in the first place, you produce significant environmental benefits throughout the life of a product

MATERIALS

For students working in pairs

- Coffee Conundrum Worksheet
- calculators

For the class

- 4 smashed 13 oz. (or similar size) steel coffee cans (smash cans by removing the bottoms, turning them on their sides and flattening them with your hand or foot).
- 13 oz. steel coffee can that is not smashed
- Four 13 oz. (or similar size) wrappers from a coffee brick

TIME

One period, *45 minutes*

Coffee is one of the most popular drinks in the United States and around the world. All of those steel cans make for a lot of waste. That's because about half of the cans end up in landfills. (About 50 percent of cans are recycled.) Perhaps you have noticed a new type of packaging for coffee – it now comes in vacuum packages called coffee bricks. Cans are made of steel, a resource which can be recycled. The brick pack is made of plastic and aluminum foil laminated together and is not currently recycled.

Students investigate two types of coffee packaging. Although one is recyclable, students see that recyclability may not always be the choice that saves the most resources. By investigating steel cans and vacuum brick packs, students will determine which package uses the fewest resources and generates the least waste. Students then decide which is the better choice environmentally. A strong case will be made for source reduction.

PROCEDURE

1. Ask students to answer this question in writing or discussion: "Which is better–recycling or reducing waste?" Ask students to explain their views. It is important that you monitor and clarify but not judge any of their answers.

2. Set out a coffee can and a brick pack. Ask students to spend a couple minutes thinking and/or writing about the advantages and disadvantages of each container. List students' ideas on the board or overhead.

3. Ask students to explain the sequence of events that takes coffee from producer to consumer. Do this as a brainstorming session, listing each step on the board or overhead, starting with "beans are picked." This sequence would be approximately: beans picked (where?), taken to packer, shipped to roaster in the U.S., shipped to market for grinding and packaging, shipped to warehouses or stores for distribution or sale.

4. Have students select a partner or divide the class into pairs. Give each pair a student worksheet and read the introduction. Explain that they will be using a calculator to complete the worksheet.

5. As students proceed through the worksheet, monitor and help students who need assistance. As students complete each part of the worksheet, stop and discuss their answers. Before students complete Part 3 of the student worksheet, stack the three crushed steel coffee cans and stack the 3 brick packs where all students can see them.

QUESTIONS

When students have completed the worksheet, discuss the following:

a. Which is better–recycling or reduction? Why? (Reduction is a better option because recyclable materials are not all recycled and recycling also uses resources.)

b. What should be the goals when dealing with the solid waste problem? (The primary goal is to use fewer resources to reduce the waste that goes to waste facilities.)

c. Which do you think would be a good choice environmentally–coffee in cans or brick packs? Give as many reasons as you can for your answer. (Students should respond using information they calculated showing that less waste and energy savings can be realized with brick packs. You may want to point out this fact: if all steel coffee cans were converted to brick packs, the savings in energy would be the equivalent of 17,200,000 gallons of gasoline.)

d. If coffee bricks use less energy and produce less solid waste, why isn't all coffee packed in bricks packs?(Students will respond with various answers. The discussion should lead

students to the idea that companies produce what consumers will buy. If consumers continue to buy coffee packed in cans instead of coffee packed in brick packs, the coffee companies will continue to package coffee in cans.)

e. In this activity, what were you most surprised about? Accept any reasonable answers.

EXTENSIONS

1. Draw a poster illustrating what happens to coffee cans and brick packs from manufacture to solid waste. Show how energy and resources are used in each step.

2. Look at the supermarket for other products that are packaged in plastic/aluminum vacuum packs. Make a list of other products that probably could be packaged this way to save energy and/or reduce waste. Why can some products, such as macaroni and rice, be packaged in plastic bags, while others must be packaged in steel cans or plastic/aluminum vacuum packs.

Teacher Notes

Answers to student worksheet

NOTE: All figures are based on U.S. production. Recycling numbers are the most recent available from Porter and Associates.

PART A

1. (a) 9.6 lbs. (b) 10.4 lbs. (c) 3 lbs.

2. (a) 150,000,000 lbs. (b) 78,000,000 lbs.

3. 25,425, 000 lbs.

4. The brick pack reduces solid waste the most.

5. The waste would be increased by the additional weight and volume of the lid. The recycling rate for these is very low.

6. It may be inconvenient to recycle, or there may be no local recycling program.

7. Although less material is landfilled, our goal is to conserve resources, so the answer is "No." If 100 percent were recycled, the recycling process for steel and forming a new product uses more energy than making a new coffee brick container.

PART B

1. 5,682 trucks

2. 16,243 trucks

3. 21,925 trucks

4. 15,347,500 miles

5. 2,557,917 gallons

6. Accept any reasonable answer about the benefits of saving fuel.

PART C

1. 2.2 ounces

2. 5,156,250 pounds (Don't forget that there are 24 cans per case!)

3. a) The brick packs have the least volume.

b) Brick packs are still less, but the cans have obviously reduced their volume significantly.

c) Cans take up more landfill space, by volume, than brick packs. Compacting makes a big difference when it comes to maximizing the use of landfill space.

Coffee Conundrum Worksheet

Names

One of the most popular drinks in the United States is coffee. With millions of people drinking it, you can imagine that coffee packaging can add up to a lot of solid waste. Most coffee is packed in steel cans, which can be recycled.

Perhaps you have noticed a new type of packaging called coffee bricks. The brick wrap is made of plastic and aluminum laminated together and is not currently widely recycled.

In the following activity we will examine how coffee packaging can have some surprising results when thinking about solid waste. So get your calculator and sharpen up your math skills as we analyze recyclable steel coffee cans and nonrecyclable coffee bricks.

PART A

How much waste reduction can be gained through packaging?

1. Let's figure out how much waste each package produces. A heavy coffee drinker consumes about 65 pounds of coffee each year. If two 65 pound batches of coffee were packaged, one batch in 13 ounce cans and the other in 13 ounce bricks, the steel in the cans would weigh 20 pounds; the brick pack wrappers would weigh 3 pounds.

It appears that the metal coffee cans produce more waste. But what about recycling? The brick pack isn't widely recycled and the steel is. The current national recycling rate for steel cans is about 48 percent according to the Steel Recycling Institute. So, for our 65 pound batch of coffee,

a. How many pounds of steel would probably be recycled? _____ pounds of steel recycled

b. How many pounds would end up as waste? _____ pounds of steel waste

c. How does this compare with waste from an equivalent amount of coffee packaged in brick packs? (Because recycling rates are not available for brick packs, assume that none are recycled for this activity.) _____ pounds of brick pack waste

2. Currently, the coffee industry uses about 900 million packages per year–600 million cans and 300 million brick packs. A 13 oz. coffee can weighs about 4 oz., while a brick pack that can hold the same amount of coffee weighs 0.452 oz.

a. How many pounds of cans are used each year? _____ pounds of steel used

b. At the current recycling rate, how many pounds of cans would end up in a landfill or waste facility? _____ pounds of steel waste

3. If all 900 million packages of coffee were packaged in brick packs, how many pounds would go to a waste facility?
_____ pounds of brick packs

4. Based on these figures, which type of packaging most reduces solid waste?

_____

_____

_____

_____

5. The steel can has a plastic lid. How would this affect the total waste of canned coffee?

_____

_____

_____

_____

6. Why aren't all steel cans recycled?

_____

_____

_____

_____

7. If 100 percent of steel cans were recycled, would that make steel a better choice? What energy considerations are there?

_____

_____

_____

_____

PART B

What other energy is involved with packaging?

1. All of the packaged coffee must be transported. For the packager to deliver 900 million packages of coffee per year, 28,409 trucks would be needed for cans and 22,727 trucks for brick packs (brick packs take up less space). How many fewer trucks would be needed for brick packs each year?
_____ fewer trucks for brick packs

2. Containers (empty steel cans or brick packs) also have to be delivered to the packager before they can be filled. If all the coffee were packaged in cans, 17,140 trucks. If all the coffee were packaged in brick packs, 897 trucks would be needed. How many fewer trucks would be needed if all the coffee were packaged in brick packs?
_____ fewer trucks for brick packs

3. How many fewer trucks would be needed each year to transport both coffee and containers if all 900 million packages of coffee were brick packs?
_____ total fewer trucks each year

4. Each truck averages 700 miles in delivery distance per year. How many miles of travel have been eliminated assuming #3?
_____ fewer miles of travel each year

5. Each truck averages 6 miles per gallon. How many gallons of fuel would be saved each year by packaging coffee in brick packs?
_____ gallons of fuel saved each year

6. Why it is good to use less fuel? List all the reasons you can think of.

PART C

What other environmental savings are related to using brick packs?

1. In addition to the container that holds the coffee (cans or packs), called the primary container, there is another container that holds all the cans or packs during shipping. This container is called the *secondary container.* For coffee cans, it is a cardboard box. Twenty four (13 oz.) cans of coffee are held in a cardboard box that weighs 16.3 ounces.

The secondary container for brick packs is cardboard trays: one on the top and one on the bottom of 24 brick packs. Then they are shrink wrapped with plastic to hold them together. This packaging weighs 14.1 ounces. How many ounces of packaging material are saved by using brick packs?
_____ ounces saved for each 24 bricks

2. There are approximately 900 million 13 oz. packages of coffee sold each year. What would be the savings in pounds of solid waste from secondary packaging by using brick packs instead of cans?
_____ pounds of waste saved

3. In this activity, we've been talking about the weight of packaging. In a landfill, the volume or amount of room something takes up is important. Look at the stack of three coffee cans and three brick packs.

a. Which takes up less space?

Now, consider the fact that items are compacted prior to landfilling. Stand on the cans and wrappers and crush them. (You can also try putting them between two books and crushing them.)

b. How much of a difference did this make?

c. How would that be important to waste disposal in landfills?